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ABSTRACT

This study evaluated a college level Introductory Psychology course taken by 23 precocious adolescents during a three-week summer residential program. This evaluation measured not only knowledge gain, but also understanding, generalization, and application of that knowledge. Immediate post measures of participants' knowledge, understanding, and value orientation were compared to similar measures from two same-age gifted comparison groups. Remote post measures, including a survey on level and type of applications of material, were obtained from recent Psychology course students and the previous year's Psychology course students. Results indicated knowledge gain from course participation was substantial and long-lived. Furthermore, exposure to course materials dramatically affected both the level of understanding and the ability to generalize from and apply psychological concepts to real world situations. While there was decay of specific informational content over time, level of understanding and ability to generalize from and apply material remained relatively constant. Value orientation was also affected: students just completing the course were quite "humanistic" in their outlook; after six months, they had become much more "behavioral/empirical". In addition, large proportions of students reported that the course had affected educational plans (50.0%) and career plans (36.7%). (Author/JGL)

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Evaluation of College Level Coursework for Gifted Adolescents: An Investigation of Epistemological Stance, Knowledge Gain and Generalization

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ABSTRACT

This paper attempts to point to a more comprehensive model of evaluation for educational programs. By focusing on four factors potentially affected by educational programs – knowledge, understanding, generalization and application – we can better understand the full effects of tailored interventions on participants. Not only will this assist educators in evaluating their work but more importantly, such information can and should, serve as a guide to developing more focused and effective educational efforts.

The present study focused on evaluating both proximal and more distal effects of an innovative course of study. Not only was knowledge gain assessed, as is typical of such evaluations, but changes in values, the level of understanding and ability to apply as well as actual applications of the material learned to real world situations was measured. The program of study evaluated was a college level Introductory Psychology course which was offered to precocious adolescents during a three week summer residential program. Study design involved immediate post measures of participants' knowledge, understanding and value orientation (N = 23). Similar measures were obtained from two same-age gifted comparison groups – other college credit course participants (N = 31) and a cross-section of other program participants not taking college credit courses (N = 22). Remote post measures including a survey concerning level and type of applications of material were obtained from recent Psychology course students (six months) and the previous Psychology course students (1.5 years, N = 24).

Results indicated that knowledge gain from course participation was substantial and long-lived. More interestingly, exposure to course materials dramatically affected level of understanding and ability to generalize from and apply psychological concepts to real world situations. Importantly, while there was decay of specific informational content over time among course participants, level of understanding and ability to generalize from and apply material remained relatively constant.

A dramatic reversal in value orientation was also noted among course participants. While students just completing the course were quite "humanistic" in their outlook, after a six month period their orientation had become much more "behavioral/empirical". In addition, large proportions of students reported that the course experience had affected educational plans (50.0%) and career plans (36.7%).

INTRODUCTION

Traditional course evaluations have focused primarily on knowledge gain and retention over time. The popularity of this form of evaluation derives from its ease of implementation and from the clarity of the results obtained. A pre-post testing procedure assesses knowledge gain and a follow-up testing after some lapse of time assesses retention. A major criticism of many of these studies is that they neglect much of what education is about. One additional educational goal is that of increasing student's understanding of and their ability to apply the knowledge that they have gained. This aim is especially important when dealing with gifted populations who are already known to be quite capable of learning a great deal of factual information. A subtler goal is to develop an appreciation of the values that characterize a field.

In every educational program students receive knowledge that they might use to interpret the most fascinating phenomena in their lives. The question that persists in evaluating the intervention is whether the information gained does in fact generalize and is applied successfully in interpreting and functioning in the real world. Some fascinating work carried out by Hestenes and his colleagues (e.g., Halloun & Hestenes 1985a; 1985b) in the area of physics has demonstrated that the common-sense misconceptions which we bring with us to educational settings are resistant to change, at least by means of traditional methods. Here, researchers' premeasures of college students' understanding of motion and causality revealed dramatic and consistent conflicts with physical reality. Postmeasures obtained after a traditional course of study in physics revealed that while students demonstrated at least reasonable mastery of the material and achieved passing grades, their level of understanding and ability to actually use the information in correcting their own misconceptions of mechanics did not improve appreciably.

Noting the distinction between information gain and understanding is, as Halloun & Hestenes (1985b) point out the first step in developing better educational interventions. The current effort attempted to assess the effects of a somewhat nontraditional course of study on knowledge gain, value change and understanding as well as students' application of knowledge.

The course selected for evaluation was Duke University's Talent Identification Program's college level introductory psychology course. The course was selected for several reasons:

- In the tough-minded behavioristic orientation adopted for the course curriculum psychology students learn about methods of perceiving that lead to very important interpretations which differ from the often erroneous common sense most people use in their efforts to understand human behavior. As such, the study of psychology provides one opportunity for researching such educational benefits,

- The format of the course is nontraditional. In addition to completing prescribed text assignments, the lecture format so revered in most educational environments is eschewed in favor of open-discussions of concepts and research areas among students, instructors and invited guests who lead symposia. Also, students are required to undertake and complete individual or group research projects and the results of these projects are presented and evaluated at a mini-convention on the final day of classes; and

- The program is offered over a three and one-half week semester to a group of between 20-25 homogeneous, very bright and highly motivated adolescents.

Because the aims and approach in this course are what they are, it seemed appropriate to ask three questions about its impact; (1) How much of the content of the course do students learn and how well do they retain it? (2) Along with factual subject matter do they acquire any skill in the area of psychological interpretation? (3) Do their value systems change as a function of course participation? The purpose of the current effort was to obtain data that bore on these questions. The study is a small one and the answers must be considered tentative. They are, however, of considerable interest.

METHOD

The subjects were drawn from a special population of adolescents identified as academically gifted by the Duke University Talent Identification Program (TIP). All of them participated in at least one term of the TIP Summer Residential Program which offers intensive, fast-paced courses lasting approximately three-weeks. Students generally complete the equivalent of a year of high school or a semester of college-level work during each three-week term. Of the approximately thirty courses four of them carry college credit. Program details have been documented elsewhere (e.g., Sawyer, 1985).

The Summer Residential Program is open to students who have completed grades 7,8,9, or 10. To qualify, students must have achieved scores in at least the 97th percentile on an age-normed standardized achievement test and, while in seventh grade, been in at least the 73rd percentile of college-bound high-school seniors on either the Math or Verbal subsections of the Scholastic Aptitude Test (SAT). Enrollment in TIP college credit courses requires a combined math and verbal SAT score of 1050, as well as, previous participation in the program.

Assessing the effects of participation in the TIP college credit psychology course with a simple pre-post procedural approach was untenable due to the reactive/sensitizing nature of a pre-measure (i.e., learning to the test). Instead, a quasi-experimental method which incorporated the students of the non-psychology college credit courses into the design to provide nonequivalent comparison groups was implemented. Post and remote post measures were used on those subjects that were enrolled in the TIP 1986 college credit psychology course. In addition, remote post measures were obtained from participants in the TIP 1985 college credit Psychology course.

Of the 100 subjects in the study, 54 were boys and 44 were girls (data on gender are unreported for 2 subjects). The total sample consisted of four groups: 22 were non-college TIP course participants in 1986, 31 were college-credit TIP participants in courses other than Psychology (Logic - N = 11, Statistics - N = 5, and Computer Science - N = 15) in 1986, 23 were college-credit TIP Psychology participants in 1986, and 24 had been college-credit TIP Psychology participants in 1985. All of the 1986 groups were tested at the end of their coursework in August 1986. The 1986 Psychology group was tested again in a follow-up by mail in January only as Psychology 1985 students were tested in January only. The general design of the study appears in the Table 1.

TABLE 1

Study Design

Group	Testing: August 1986 Testing	Testing: January 1987 Testing
(1) Non-college-credit 1986	N = 22	
(2) Non-Psych college-credit 1986	N = 31	
(3) Psychology 1986	N = 23	N = 23
(4) Psychology 1985		N = 24

PROCEDURE:

During the last scheduled class day of the Summer Residential Program groups 1 through 3 (Table 1) completed a series of three written tests: Psychological Information and Vocabulary, Psychological Interpretations, and Epistemic Differential.

The test of Psychological Information and Vocabulary consisted of 50 five-alternative multiple-choice items. Some of the items were vocabulary items; some covered basic psychological knowledge; some were mixtures of the two. This test measured mastery of the course material; a measure such as this is basic to any evaluative effort.

The test of Psychological Interpretations consisted of 50 true/false items which required application of psychological knowledge or theory to real world situations. How well students understood and could apply what they had learned was assessed using the two sets of scores derived from this test. The total number of correct answers given indicated the INTERPRET score (Table 2). Twenty-four of the items in the test functioned as an internal subtest which provided a means of assessing the consistency of the students' understanding (Table 3). These twenty-four items tested twelve ideas in two paired questions (e.g., "You are never too old to learn" and "You can't teach an old dog new tricks"). Subjects who responded correctly or incorrectly to both of the related items were identified as having a consistent understanding of the topic. Two correct answers for a pair was considered

a "correctly consistent" score; two incorrect answers for a pair was considered an "incorrectly consistent" score. One correct and one incorrect answer in a pair was considered an "inconsistent" score.

The Epistemic Differential was a version of the instrument used by Kimble (1984) to demonstrate the existence of polarized scientific and humanistic cultures within psychology. This assessment required subjects to rate reactions to eight short paragraphs presenting bipolar values. As recommended by Kimble, scores were obtained by subtracting the number of items answered in a scientific direction from the number of items answered in a humanistic direction. The range of scores is from -8 (the extreme scientific pole) through zero, to +8 (the extreme humanistic pole).

Students completed the August, 1986, tests in their respective classrooms and were given ample time to attempt all questions in each test. The follow-up was conducted by mail in January, 1987, using only those subjects in the two groups that had taken the psychology course. These groups were sent a questionnaire to complete along with the same three written tests administered in August. The questionnaire asked about students' use of the information learned in the course, relevant activities such as reading further in the area and perceived impact of the coursework in their life especially regarding educational or career plans. Answer sheets and the questionnaire were returned in pre-paid return envelopes enclosed with the material sent to each subject. Students were prompted with reminder cards in early February to facilitate material return (Correct address information was unavailable for at least two subjects whose data are missing). The return rate for this portion of the study was 68.1%.

RESULTS AND DISCUSSION:

Univariate *F* tests were performed to contrast scores achieved by the four groups of students on each of the three sets of dependent measures. The results of this analysis are presented below along with means for each test.

TABLE 2

Phase I Results

Groups

	Non-College Credit	Coll-credit	Psychology 1986	Psychology 1985	
	N = 22	N = 29	N = 22	N = 15	
	M	M	M	M	*F*
Epistemic	1.45	1.93	2.35	0.14	2.06
Knowledge	18.23	19.00	33.56	28.57	21.04*
Interpretations	27.73	28.61	34.14	32.67	6.66*

* $P < .0001$

As expected, the students who had been enrolled in TIP psychology (1985 or 1986) perform better on both the Knowledge and Interpretation tests than the students in the non-psychology TIP courses. These differences between the psychology groups (psych 1985 and psych 1986) and the non-psychology groups for both knowledge and interpretation scores were determined to be significant (Scheffe's test). This implies that both the level of mastery of material and the ability to apply what was learned increased as a result of participating in the psychology course and was maintained even after a one and one-half year hiatus.

The mean difference between psychology 1985 and psychology 1986 on knowledge scores was significant, while that for the interpretation scores was not. This suggests that the amount of knowledge retained tends to decrease with time, but that the ability to apply material to real world situations does not. Other analyses of self-report measures suggest that this may be due to the amount the students actually use the learned material in their day to day efforts.

Although there was no significant difference between groups on their epistemic stance, it is interesting to note that the psychology 1986 group tended to be slightly more humanistic than other groups, while psych 1985 was the most scientifically oriented of all groups. We will return to this point later. Scores on the epistemic differential were not related significantly to any of the other test performance scores.

TABLE 3

Consistency of Correct Responses on the Interpretations Measure

Groups	Non-college Credit	Coll-credit	Psychology 1986	Psychology 1985	
	N = 22	N = 29	N = 22	N = 15	
	M	M	M	M	*F*
Incorrectly Consistent	2.64	2.59	1.50	2.47	3.78*
Correctly Consistent	4.64	3.83	5.23	5.00	4.23*
Inconsistent	4.82	5.59	5.27	4.53	1.62

* $p < .01$

Table 3 presents the three measures derived from the Interpretations test. The "correctly consistent" score is the number of correct answers given for the two questions which test the same concept. The "incorrectly consistent" score is the number of items on which both questions were answered incorrectly. The "inconsistent" score is the number of pairs where the subject got one correct and one incorrect.

A student who is unfamiliar with a topic or who does not have a definite belief about it may have a difficult time reasoning consistently when the topic is presented indifferent ways. Such a student may be more likely to guess at an answer unlike the student who makes use of a misconception. Here the student is more likely to answer both questions wrong. This occurs because their reasoning is based upon the same false belief whenever that particular concept is tested.

Results of univariate *F* tests indicate that psychology students had significantly lower incorrectly consistent scores and higher correctly consistent scores than those of the other groups. The groups did not differ on the number of pairs responded to inconsistently. Since the consistency measures are not independent, multiple *F* tests must be viewed with caution. It is, however, interesting to look at the trends across groups. These results imply that the students completing the psychology course probably have fewer misconceptions about psychological concepts than other students and that they apply learned material with greater success.

Interestingly, there appears to be only a slight but positive relationship between how much fatual knowledge psychology students have obtained (Knowledge scores) and how well these students apply the facts (interpretation scores) that they know (Pearson's $r = .26$, $p<.25$). Given the high "correctly consistent" score on the Interpretation measure and the observed relation btween Interpretation and Knowledge scores, the course training seems to have had the effect of lowering the number of misconceptions student have; not by providing facts alone, but by making that factual information extensible to real world situations.

Table 4 portrays differences of performance between the initial testing and follow-up testing for the 1986 psychology group.

TABLE 4

Change over Time for Psychology Students

	August	January		
	N = 22		N = 17	
	M	M	M Diff	t
Epistemic	2.35	.53	-1.71	-3.07*
Knowledge	33.56	29.50	-3.60	-4.10**
Interpretations	34.14	33.81	.71	.77

*p< .01 **p< .001

The Knowledge test scores showed a significant decline and the Epistemic Differential measures evidenced a change during the 5-month period following initial testing.

The change in Epistemic Differential scores indicates a significant movement in the scientific direction. These data suggest that students possessing slightly more humanistic attitudes are more likely to enroll in a psychology course (Epistemic premeasure = 2.35), or that they obtain slightly more humanistic attitudes as an immediate effect of course participation. After participation in the psychology course and some lapse of time, however, their attitudes take on more of a scientific tone than prior to the educational experience. Interestingly, the 1986 students do not differ at the point of the postmeasure from the 1985 students who had been away from the course for 17 months (Table 5). Suggested here is the intriguing idea that these attitudinal changes are a slow acting after-effect of the course.

Also to be noted is that although scores for the knowledge gain measure decrease significantly, the measures indicating understanding and proficiency for applying material decrease only very slightly. The relatively stable interpretation scores suggest that little if any return to previous misconceptions occurs. These results also support the findings that knowledge gain and ability to successfully apply information may not be significantly related.

TABLE 5

Contrasts Between Remote Post Measures for Psychology Students

	Groups		
	Psychology 1986		Psychology 1985
	N = 17		N = 15
	M	M	F
Epistemic	.53	.14	1.69
Knowledge	29.50	28.57	.15
Interpretations	33.81	32.67	.52

Univariate *F* tests for the January 1987 groups revealed no significant difference between the 1985 and 1986 groups on any of the measures even though 5 and 17 months, respectively, had passed since students had taken the course. The results for the Knowledge and Interpretation tests imply that after a certain amount of early forgetting has taken place (Table 4), the materials acquired in the course remain fairly stable over time.

As part of this study, a supplementary questionnaire was administered in January to determine if and what types of further psychological study or related activities students say that they engage in following course

completion. These data also provide some insight into possible contributing factors which may have helped in sustaining scores on the Interpretation measure.

Since no significant difference was observed for the 1985 and the 1986 psychology groups, discussion of questionnaire results are done with the groups combined. A summary of the answers to this questionnaire appears below.

LEVEL OF INTEREST:

Forty percent (40%) of the students said that their level of interest in psychology increased substantially as a result of course participation. Another 40% felt that their level of interest increased and 13.3% felt it neither increased nor decreased. Only 6.7% did not respond to the question.

For the question of how frequently they found themselves thinking about what was learned in the course, 20% felt that they thought of what they had learned very frequently, 30% said frequently, 36.7% occasionally, and 6.7% rarely. No students responded that they "never thought" of what they had learned. Item nonresponse was 6.7%.

INTERPRETATIONS:

When asked if there had been occasions in which knowledge gained from the course influenced personal interpretations of events, of others, or of oneself, 66.7% of the students said that there had been such occasions. The most frequently described situations were ones of social context. Students felt that the coursework had enabled them to analyze social situations better and to act more rationally. A few felt that they had become more "opened-minded". The remaining 33.3% said that the coursework had not influenced their interpretations.

PRACTICAL USE:

Fully 60% of the students could recall occasions when they made practical use of information learned in the course, 20% said they could not think of such an occasion, and 20% did not respond. Students tended to make use of information in their high school courses for writing research papers and also as an aid for studying. Other students made use of information to explain the behavior of peers who were involved with drug or alcohol use. Another used information personally in dealing with stress in school and at home. Thus, coursework seems to give students the framework to assist in their everyday living.

RELATED COURSE WORK & INDEPENDENT STUDY:

Only 6.3% of all students enrolled in any related course at their home school or a nearby University. However 68.8%, said they have continued their studies independently, almost exclusively in the form of supplementary reading. 16.7% said they have subscribed to psychology magazines, 56.7% said that they read psychology magazines, 16.7% report reading psychology journals, 43.3% have continued study using textbooks, and 46.7% said that they are reading psychological fiction.

Students report that the information they have learned in psychology is extensible to situations in their everyday life and that they can recall making use of it. Perhaps it is this exercise in practical application which keeps interpretation scores from significantly declining along with those for knowledge gain. The fact that students seem to be reading on their own must also be mentioned as a possible contributor to sustained ability to apply learned material. Regardless of the nature of all contributing factors, educational programs such as TIP psychology, can have an impact on understanding and the ability to apply material remain stable over time even when levels of knowledge gain decrease.

EDUCATIONAL & CAREER PLANS:

Just as it is important to change levels of understanding as part of the educational process, it is important to help develop human resource. Perhaps one of he most important areas of potential impact of educational programs, especially those targeted for adolescence, is in exposing students to a new area in such a way as to engage their continuing interest. Here, the program seems to be highly successful: 50% of responding students report that their experience in TIP's Introductory Psychology course influenced educational plans. This reported influence ranged from prompting the desire to further their study of psychology in college on an elective basis, to choosing psychology as a college major and possibly obtaining a Ph.D. in graduate school. Fully, 36.7% of the students felt that the course had influenced their career plans.

IMPLICATIONS:

This study evidences a need for movement beyond the finely focused traditional approach to course evaluation. It seems necessary to go well beyond measures of information gain and retention to look more directly at understanding and application. This may be especially true with gifted populations who can absorb facts like a sponge does water. The model demonstrated is more comprehensive and focuses broadly on knowledge, understanding, and application. With a little use of their own resources, educators, especially of the gifted, could better apply what they know and develop more comprehensive evaluative models. These well might be of significant importance in designing better curriculum and in better educating adolescents.

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